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Empathy Emerges: How Social Impairment and Familiarity Impact the Development of Empathy During the Second Year of Life

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Empathy Emerges: How Social Impairment and Familiarity Impact the Development of Empathy During the Second Year of Life

by

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Dedication

To my parents,

for their endless love, support, and encouragement.

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Abstract

Empathy Emerges: How Social Impairment and Familiarity Impact the Development of Empathy During the Second Year of Life

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The University of Texas at Austin, 2015

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The ability to understand and share another's feelings emerges within the first year of life in typically developing children. Impaired empathic responses, occurring early in development, such as those observed in young children with Autism Spectrum Disorder (ASD), can negatively impact subsequent social development. Understanding what individual and situational contexts contribute to successful empathic responses is crucial to understanding how these impairments manifest. The current study explores potential relations between early empathic responses to the distress of a social partner and: 1) early markers of social impairment, and 2) familiarity with person in distress. Infant siblings of children with (high-risk) and without (low-risk) ASD were assessed at 12 (n=29) and 15 (n=35) months, using the Autism Observation Schedule for Infants (AOSI) as a measure of social impairment. Infants' responses to both their mother and the experimenter feigning distress were also evaluated at 12 and 15 months. Individual differences in social impairment impacted infants' attention and affective responses at 15 months but not 12 months. While empathic responses increased for those with little to no

social impairment, those with high social impairment were not making developmental gains over time. Infants attended more to the unfamiliar person (experimenter) in distress across 12 and 15 months. While infants displayed more affect for the familiar person in distress at 12 months, they responded similarly to both people at 15 months, suggesting that affective responses are generalizing to unfamiliar people over time. Implications of this research, such as early interventions, as well as limitations and future directions are discussed.

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Empathy Emerges

Empathy is broadly defined as understanding and sharing another's feelings. While there have been many specific definitions of empathy, empathy has been consistently recognized as an important construct across different fields of psychology (see Decety & Meyer, 2008). "The development of empathy, in turn, is crucial for social competence, social relatedness, and prosocial behaviors" (Maynard, Monk & Booker, 2011, p. 166). Empathy may play an important part in the development of social relationships. For example, empathy predicts later prosocial behaviors (Roth-Hanania, Davidov, & Zahn-Waxler, 2011), and prosocial behaviors are related to supportive friendships (Sebanc, 2003). Furthermore, the development of empathy is thought to influence moral development (Simmons, 2014), which may influence peer relationships, for example, in the context of bullying in adolescents (Caravita, Di Blasio, & Salmivalli, 2009). Sharing others' feelings was negatively related to adolescents' involvement in bullying others and positively related to their involvement in defending victimized peers (Caravita et al., 2009). Thus, social relationships could be negatively impacted if one partner fails to empathize with the other.

One common conceptualization of empathy consists of two dependent components: cognitive empathy and affective empathy (Knafo et al., 2009). *Cognitive empathy* refers to one's ability to comprehend another person's distress, through understanding the situation and recognizing the other person's feelings. In young children, cognitive empathy "appears in the form of hypothesis testing or inquisitiveness, whereby the child actively tries to understand the other's problem" (Knafo, Zahn-Waxler, Van Hulle, Robinson, & Rhee, 2008, p.737). *Affective empathy* refers to experiencing the

other person's emotional state and is evident in young children from their "emotional expressions of concern for the victim" (Knafo et al., 2008, p.737).

Cognitive and affective empathy are highly correlated and, thus, considered dependent components of a single construct of empathy (see Knafo et al., 2009). Furthermore, both cognitive and affective empathy are associated with similar activation in overlapping brain regions (Singer, 2006). Interestingly, however, cognitive and affective empathy appear to have different developmental trajectories, with cognitive empathy developing later than affective empathy (Singer, 2006). These developmental differences are likely related to the development of the brain regions that are uniquely associated with each component (Singer, 2006). For example, the limbic and para-limbic systems that are uniquely associated with affective empathy develop prior to the temporal lobe and prefrontal cortex that are uniquely associated with cognitive empathy (Singer, 2006). Therefore, it is important to examine the development of both components and perhaps to designate different age-appropriate developmental milestones for each element.

Previous research suggests that empathic responses emerge within the first year of life (see Davidov, Zahn-Waxler, Roth-Hanania, & Knafo, 2013) and continue to develop in early childhood (Knafo et al., 2008; Roth-Hanania et al., 2011; Zahn-Waxler, Radke-Yarrow, & King, 1979; Zahn-Waxler, Radke-Yarrow, Wagner, & Chapman, 1992). As young as 6-month-olds, infants directed their attention, even orienting, toward their crying peers (Hay, Nash, & Pederson, 1981). Roth-Hanania et al. (2011) found modest amounts of both cognitive and affective empathy were already evident by 8 to 10 months of age. The strength and variety of these empathic responses increases over time in typical development (Geangu, Benga, Stahl, & Striano, 2011; Zahn-Waxler & Radke-Yarrow, 1990). However, individual differences in empathic responses are also apparent

at each age across these early developmental periods. It is important to understand what factors contribute to the successful development of both cognitive and affective empathy, and may explain individual differences in children's empathic responses to another's distress.

EMPATHY IN CHILDREN WITH ASD CHARACTERISTICS

One possible explanation for individual differences in infants' empathic responses is the quality of their general social functioning or the degree to which infants are successful in other social interactions. Previous research has presumed that all children are equally interested in the social interaction as part of an innate desire to want to interact with others (Nagy, 2008). However, the social motivation hypothesis would suggest that those who struggle in social interactions might not have the same innate social interest (Chevallier, Kohls, Troiani, Brodkin, & Schultz, 2012). Furthermore, Mundy & Neal (2001) theorize that early social attention deficits deprive children of crucial social information that impacts their neurodevelopment and, subsequently, results in deficits in their social cognition and social behavior. Therefore, a lack of social motivation may result in reduced social attention, which in turn may result in deficits in responding empathically, as it is a more complex social construct. If infants are not attending to their social partner, they are not likely to be inquisitive about their social partner or they may lack information and thereby struggle in their attempts to understand why another person may be in distress (e.g., struggle with cognitive empathy). Likewise, if infants struggle with basic emotion recognition skills, then they may also struggle with affective empathy. Individual differences in the tendency to attend to a social partner or identify another's emotions likely influence individual differences in cognitive and affective empathy. Furthermore, when social attention and emotion recognition are

impaired, these deficits may impede the development of other complex social responses, such as empathy.

Individuals with Autism Spectrum Disorder (ASD) manifest deficits in social attention (Bhat, Galloway, & Landa, 2010; Chawarska, Macari, & Shic, 2013; Dawson, Meltzoff, Osterling, Rinaldi, & Brown, 1998; Osterling, Dawson, & Munson, 2002), emotion recognition (Harms, Martin, & Wallace, 2010; Kuusikko et al., 2009; Lozier, VanMeter, & Marsh, 2014; Uljarevic & Hamilton, 2013), and empathy (Bacon, Fein, Morris, Waterhouse, & Allen, 1998; Charman et al., 1997; Hutman et al., 2010; McDonald & Messinger, 2012; Sigman, Kasari, Yirmiya, & Kwon, 1992). ASD is a neurological developmental disorder characterized by deficits in social interactions and communication (American Psychological Association [APA], 2013). While deficits in responding empathically are not part of the diagnostic criteria for ASD, research has shown that children with ASD are not as empathically responsive as their typically developing peers or even as responsive as children with other developmental disorders (Bacon et al., 1998; Charman et al., 1997; Dawson et al., 2004; Sigman et al., 1992). It is important to note, however, that deficits in social functioning are not limited to those who meet diagnostic criteria for ASD. Infants who have a sibling with ASD (high-risk, HR) are at increased risk of being diagnosed with ASD (Hallmayer et al., 2011; Ozonoff et al., 2011). Furthermore, these HR infants are also more likely to develop subclinical ASD characteristics known as the broader autism phenotype (BAP), which include deficits in social functioning (Ozonoff et al, 2014). Research has yet to fully explore how concurrent deficits in social functioning impact children's responsiveness to another's distress early in development.

In order to examine how individual differences in social functioning relates to the development of empathy, we must examine the full range of social functioning, from

typically developing infants without any social impairment to those with ASD who have more severe social impairment. Thus, it may be ideal to work with a population that is at risk of developing a broad array of deficits in social functioning, such as HR infants. In a prospective longitudinal study of HR and low-risk (LR) infants from 6 to 36 months, Ozonoff et al. (2014) found that 28% of the HR children were classified as non-typically developing (non-TD), having characteristics consistent of the BAP. They also found that these atypical characteristics were detectable by 12 months of age. Previous research on joint attention (Sullivan et al., 2007) and social referencing (Cornew, Dobkins, Akshoomoff, McCleery, & Carver, 2012) has even shown differences between the HR non-ASD and LR TD infants, suggesting that some deficits in social functioning are prevalent in this HR population.

Few prospective, longitudinal studies with infants have examined empathic responses in this young HR population. McDonald and Messinger (2012) assessed for empathic responses to their parent's distress in HR toddlers at 24 and 30 months and found that HR toddlers diagnosed with ASD exhibited less global empathic concern, less bodily arousal, and less concern than the HR toddlers who were not diagnosed with ASD. The authors also found that those infants who were less responsive to their parent's distress had higher ASD symptom severity at 30 months. This finding suggests that individual differences in the range of social impairment may be related to individual differences in empathic responses.

In the youngest study of empathy with this population, Hutman et al. (2010) explored infants' empathic responding to an experimenter's distress at 12-, 18-, 24- and 36-months in a longitudinal study of HR and LR infants. Emerging at 12 months of age and stable through 36 months, infants later diagnosed with ASD were less attentive and displayed fewer affective responses than their HR and LR non-ASD peers (Hutman et al.,

2010). These distress responses were predictive of having an ASD diagnosis at 36 months (Hutman et al., 2010). Interestingly, the HR and LR infants who were not diagnosed with ASD later displayed similar attention and affective responses between 12 and 36 months, with only one exception: the HR non-ASD infants displayed more affective responses than the LR infants at 12 months (Hutman et al., 2010). Because the HR and LR non-ASD infants had similar affective responses by 18 months, the group difference at 12 months suggests that this period between 12 and 18 months may be a crucial time for the development of affective responses.

PERSON IN DISTRESS

One important developmental question that previous research has attempted to answer is: To what extent does empathy generalize across contexts? Related to this question is whether young children respond differently to the distress of a familiar as opposed to unfamiliar person. Characteristics of the parent-child relationship, such as parental sensitivity and attachment security, are thought to impact the early development of empathy (Berkowitz & Grych 1998; Hoffman, 1975; see van der Mark et al., 2002). Thus, when examining the development of empathy, it may be particularly important to determine if and how the empathic responses of young children may differ depending on the child's familiarity with the person in distress.

Research comparing toddlers' empathic responses to a mother versus an examiner in distress between 14 and 36 months has resulted in mixed findings (Knafo et al., 2008; van der Mark et al., 2002; Young, Fox & Zahn-Waxler, 1999). Van der Mark et al. (2002) found that 16-22 month olds displayed higher affect, a stronger empathic response, for their mother in distress than for an experimenter in distress. Similarly Young, Fox & Zahn-Waxler (1999) found that toddlers displayed relatively more concern

for their mother than a stranger at 24 months. However, the authors acknowledged that the toddlers were also responsive to the unfamiliar adult. Knafo et al. (2008) conducted a longitudinal study assessing for toddlers' cognitive and affective empathy in response to both their mother and the experimenter in distress at 14, 20, 24, and 36 months. Post hoc analyses of the empathic responses at each age revealed that infants displayed more hypothesis testing or inquisitiveness (cognitive empathy) towards the experimenters' distress at 14 months and more toward the mothers' distress at 20, 24 and 36 months. They also found that infants had increased affect for their mother in distress at 20 months; however, in contrast to previous research, they found that infants had more empathic concern (affective empathy) for the experimenter in distress at 14 and 36 months. Additional research is needed to explain these mixed findings and to identify if situational differences are apparent prior to 14 months.

CURRENT AIMS

The first study aim was to examine how infants' empathic responses vary with respect to the level of social impairment present at 12 and 15 months of age. Rather than compare HR and LR infants or compare infants based on their diagnostic outcome, we were interested in understanding how a broad range of social impairment, based on the number of early signs of ASD present, impacts infants' attention and affective responses to another's distress. We hypothesized that as social impairment increased, infants would display fewer empathic responses. Specifically, we expected that infants with more social impairment would display less affect than their peers at 15 months and that they would attend less to the distress display than their peers at 12 and 15 months.

The second study aim was to identify if and when infants' familiarity with the person in distress impacted their empathic responses. To differentiate responses to

familiar and unfamiliar people, we compared infants' responses to their mother in distress versus an experimenter in distress at 12 and 15 months. We hypothesized that infants would exhibit more empathy for their mother in distress than for the experimenter in distress at both 12 and 15 months.

Method

PARTICIPANTS

Thirty-nine infants participated in the study. Infants were categorized into one of two groups. Infants were classified as high-risk (HR) if they had an older sibling who had been diagnosed with autism. Infants were classified as low-risk (LR) if they had an older sibling who had not been diagnosed with autism. Infants were recruited via letters and fliers distributed to University of Texas at Austin resources (e.g., the Children's Research Lab, childcare centers, etc.) and various off campus sites such as community childcare centers and local autism organizations and providers. Inclusion criteria were: being born at or after 37 weeks of gestation, having an older sibling less than 25 years of age, exposure to English as a primary language, and a mother over the age of 18. The autism status of the HR siblings was confirmed with a laboratory administration of the Autism Diagnostic Observation Scale-Second Edition (ADOS-2; Lord et al., 2012). The Social Communication Questionnaire (SCQ; Rutter, Bailey, & Lord, 2003) was completed for the older siblings of LR siblings to ensure that they did not meet criteria for autism. All HR older siblings met ASD diagnostic criteria on the ADOS; all LR older siblings did not exceed clinical cutoff on the SCQ.

LR infants joined the study at 9 months. HR infants joined the study at 9, 12, or 15 months due to the challenges associated with recruiting HR infants. Data was collected for 29 infants (13 males) at 12 months and 35 infants (18 males) at 15 months (Table 1). A subset of these infants only contributed partial data due to incomplete appointments (n=5 at 12 months; n=6 at 15 months) and recording equipment errors (n=5 at 12 months; n=2 at 15 months).

Table 1: Enrollment and Attrition by Group and Time Point.

	HR	LR
12 months		
Actively enrolled	13	20
Missed time point	2	2
Incomplete AOSI	0	0
Codable distress tasks		
EXP	9	12
MOM	10	14
15 months		
Additional enrollment	6	N/A
Actively enrolled	19	20
Missed time point	2	2
Incomplete AOSI	0	2
Codable distress tasks		
EXP	16	13
MOM	14	17

PROCEDURE

Social impairment was assessed at 12 and 15 months using the Autism Observation Scale for Infants (AOSI; Bryson, Zwaigenbaum, McDermott, Rombough, & Brian, 2008). The AOSI is a semi-structured, 18-item observational assessment of early markers for autism (e.g, difficulty making eye contact, orienting to name when called, having social interest and shared affect with the experimenter, reciprocating social smiles, imitating, disengaging attention, etc.) A trained examiner rates the infant's performance on each item on a zero to three Likert scale. A score of zero is indicative of behavior that is expected from a typically developing infant. Scores from one to three signify atypical responses, with higher numbers indicating a greater deviation from the norm. The total number of items scored in the atypical response range (one to three) for each infant is counted to obtain the outcome score (AOSI total marker count), ranging from zero (no items with atypical behaviors) to 18 (all items indicate atypical responses).

In this study, the AOSI total marker count[1] (ASD Markers) is used to provide an index of social functioning.

Empathy was assessed using the paradigm reported in Hutman et al. (2010). In our study, both the mother (MOM) and the experimenter (EXP) simulated distress following the same instructions. For example, the experimenter feigned distress, pretending to hurt her finger on a toy that she and the infant had been engaged with (stacking toy, barn, etc.). The distress period began when the experimenter feigned distress, discontinued playing, and said, "Ouch, I hurt my finger!" For fifteen seconds, the experimenter continued to make similar remarks about hurting her finger while she shook her hand, alternatively grabbed and examined her finger, and continuously displayed distressed affect. Mothers similarly completed this paradigm pretending to snap their fingers on a clipboard. A script, outlining the paradigm, was provided to the mothers to follow during their administration, and the experimenter prompted the mother to begin and end the task. The tasks were video-recorded using two different camera angles.

Attention and affective responses were coded offline utilizing the coding scheme employed by Hutman et al. (2010). Coders scored the infants' overall affective response during the task on a four-point scale, ranging from no response to varying displays of concern or prosocial behavior. The distinction between scores zero to three indicates the number, intensity, and duration of behaviors that indicate concern or distress (Hutman et

[1]*The AOSI also yields a total score that reflects the overall severity flagged for each item, summed across all items. The total marker count was utilized in this study in order to examine the number of different atypical behaviors because any atypical behaviors, whether mild or severe, could contribute to individuals' social impairment.*

al., 2010). Infants who showed clear interest and had an intense reaction to the simulated distress, such as imitating the examiner or parent, approach or avoidance behaviors, referencing the examiner while manipulating the distress toy to understand how it hurt her, and intense emotional distress, such as crying, received a score of three. Infants who received a score of zero ignored the experimenter, had an inappropriate affective response (laughing), or did not appear startled in response to the event. Reliability was established using intra-class correlations based on absolute coder agreement between the author and additional coders that yielded high values (0.89-1).

Infants' attention to the empathy task (i.e., distress display) was similarly coded as 'Attending' or 'Not Attending' as outlined by Hutman et al. (2010). Infants were coded as 'attending' to the task if they were looking at one of three target places: experimenter, mother, or distress toy. While Hutman et al. (2010) transformed attention into a 3-point Likert scale rating, this study calculated attention as the percent time that the infant was 'attending' to the distress display (i.e., Percent Attending[2] = 'Attending'/('Attending' + 'Not Attending') in order to capture the full spectrum of variability in attention across infants. Reliability for attention was established between the author and additional coders with Kappa scores ranging from 0.83 to 0.94.

[2]*This study utilized an additional code for 'Unknown' to capture any periods of time when the infant's face was off-screen. The duration of the 'Unknown' period was not included when calculating Percent Attending.*

Results

DESCRIPTIVE STATISTICS

To evaluate the range of social impairment in our sample at 12 and 15 months, the means and standard deviations for ASD Markers (AOSI total marker counts) were calculated at 12 and 15 months for the entire sample, as well as the HR and LR groups (see Table 2). ASD Markers were marginally higher at 15 months than at 12 months ($t(58.9)=-1.74$, $p=0.086$). As expected based on previous research (Gammer et al., 2015), t-tests showed the HR infants had significantly more ASD Markers than the LR infants at 12 ($t(39.3)=3.57$, $p<0.001$) and 15 months ($t(62.6)=5.22$, $p<0.001$, Table 2), confirming that variability in symptoms observed in our HR sample is consistent with previous research. It is also important to note, however, that there were HR infants who presented with few ASD Markers and there were LR infants who presented with several ASD Markers (Table 3).

Table 2: ASD Markers at 12 and 15 Months by Risk.

	Combined	HR	LR
12 months			
Mean *(sd)*	4.06 *(2.62)*	5.55 *(2.60)*	3.17 *(2.22)*
15 months			
Mean *(sd)*	5.42 *(3.44)*	7.24 *(2.77)*	3.5 *(3.03)*

Table 3: Distribution of ASD Markers at 12 and 15 Months by Risk.

	0-3	4-7	8-12
12 months			
HR	2	6	3
LR	11	6	1
15 months			
HR	2	7	8
LR	9	6	1

LME ANALYSES

In order to determine if social impairment and familiarity were related to Attention and Affect across 12 and 15 months, linear mixed-effects (LME) models were conducted separately for Attention and Affect as the outcome variables, with Age, ASD Markers (AOSI total marker counts), and Person (EXP vs. MOM) as the independent variables[3]. The initial full LME models included random slopes and intercepts per ID. The optimum models were identified by omitting non-significant interaction terms, non-significant main effects, and random slopes, in this order. Only one fixed-effect or random-effect was removed at a time. Each reduced model was compared to the previous model, and the specific effect in question was removed from the model if its removal reduced the AIC. We further confirmed that the simpler, reduced models fit the data equally well as their preceding fuller models by using likelihood ratio tests which showed that the fits of the reduced and fuller models were not significantly different from each other. Table 4 shows the coefficients and standard errors of these coefficients for each term included in the final optimal models for Attention and for Affect. The significant main effects and interactions resulting from these optimal models are shown in Figures 1-4. Neither the optimum model for Attention or Affect included a significant ASD Markers by Person interaction term; therefore, the optimal models were graphed separately for ASD Markers and for Person. The optimum LME model for Affect included random slopes for Age suggesting that there is some variance over time that we are not able to account for with our sample.

[3]*Duration of Distress was also included as an independent variable in initial models examining main effects, but as it was not significant in either model, this variable was removed from further analyses.*

Table 4: Optimal Models for Attention and Affect Over Time.

	Attention		Affect	
	Coefficient	SE	Coefficient	SE
Intercept	-51.630	36.138	-4.606*	2.105
Age	10.723***	2.617	0.493**	0.153
ASD Markers	30.340***	6.927	0.527	0.375
PersonMOM	-8.469*	3.545	3.639**	1.282
Age : ASD Markers	-2.401***	0.490	-0.048^{+}	0.027
Age : PersonMOM	NA	NA	-0.251**	0.093

Notes. ^{+}p=.075, *p<.05, **p<.01, ***p<.001

The optimum LME model for Attention yielded a significant Age by ASD Markers interaction (p<0.001). As Figure 1 reveals, the nature of the interaction is such that Attention decreased between 12 and 15 months as ASD Markers increased. Similarly, the optimum LME model for Affect yielded a marginally significant Age by ASD Markers interaction (p=0.075), such that as ASD Markers increased, Affect decreased between 12 and 15 months (Figure 2). The optimum LME model for Attention also yielded a significant main effect of Person (p=0.020), such that infants attended more to the experimenter in distress than to their mother in distress (Figure 3). In contrast, the optimum LME model for Affect yielded a significant Age by Person interaction (p=0.009). As Figure 4 reveals, the nature of the interaction is such that between 12 and 15 months there is an increase in infants' affective responses to experimenter distress.

Figure 1: Estimated Attention for a Range of ASD Markers, Averaged Across Person.

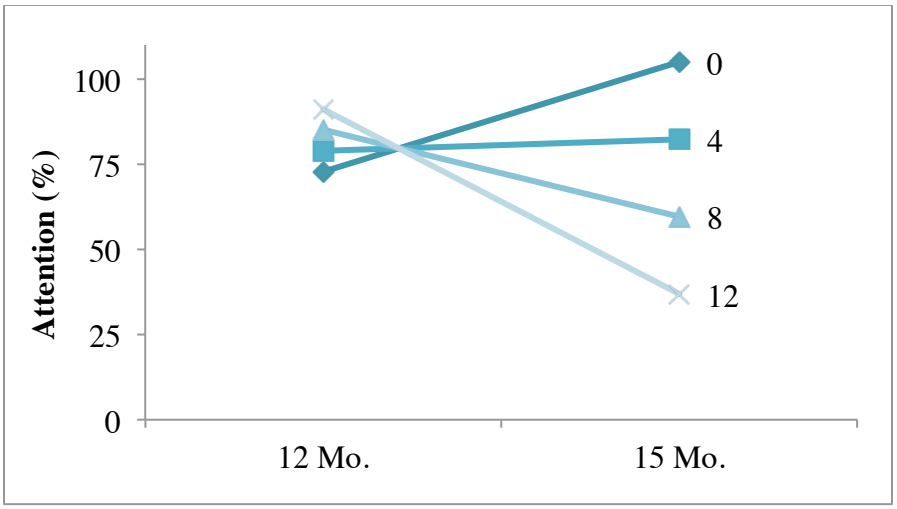


Figure 1 depicts the nature of the Age by ASD Markers interaction. Estimated values for Attention for a range of ASD Markers, averaged across predicted responses for experimenter and mother in distress.

Figure 2: Estimated Affect for a Range of ASD Markers, Averaged Across Person.

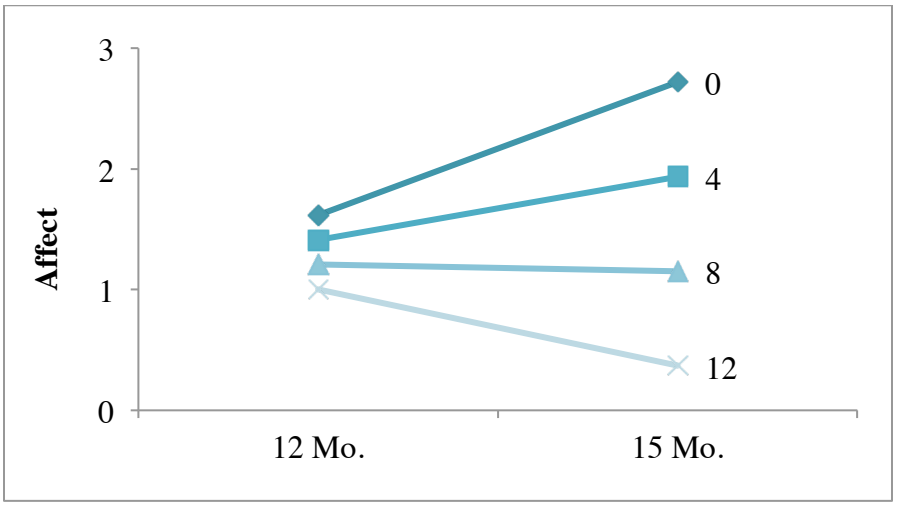


Figure 2 depicts the nature of the marginal Age by ASD Markers interaction. Estimated values for Affect for a range of ASD Markers, averaged across predicted responses for experimenter and mother in distress.

Figure 3. Estimated Attention by Person with Four ASD Markers Present.

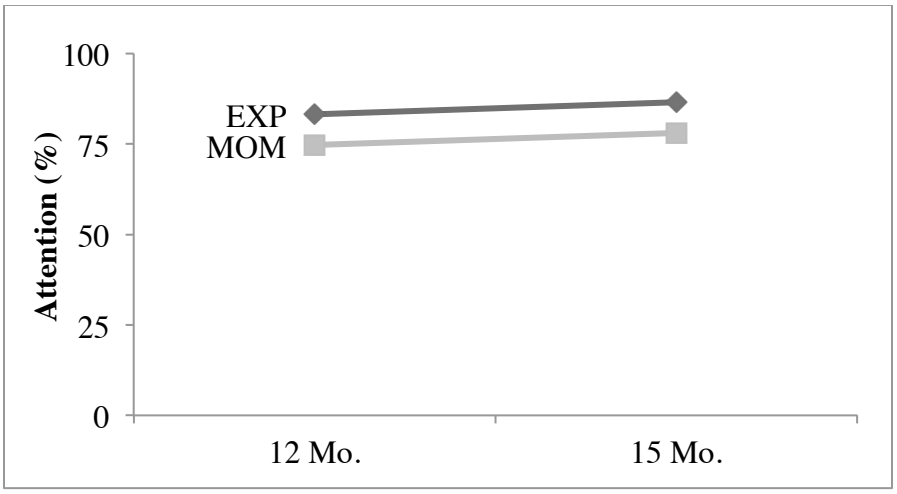


Figure 3 depicts the main effect of Person. Estimated values for Attention for experimenter and mother in distress when four ASD Markers are present.

Figure 4. Estimated Affect by Person with Four ASD Markers Present.

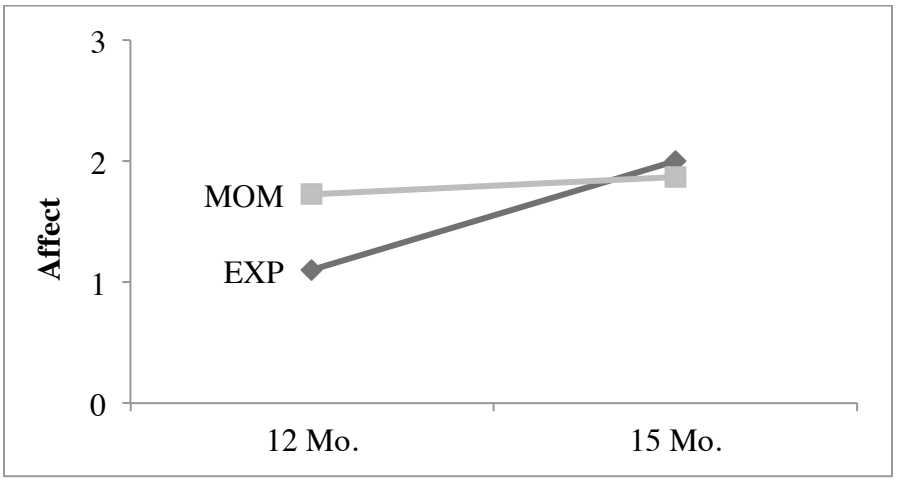


Figure 4 depicts the nature of the Age by Person interaction. Estimated values for Affect for experimenter and mother in distress when four ASD Markers are present.

POST HOC AGE COMPARISONS

Additional post hoc analyses were conducted to identify if the effects of ASD Markers and Person were significant within each time point. LME models were similarly conducted separately for Attention and Affect as the outcome variables; however, these models tested the main effects of ASD Markers and Person separately at 12 and 15 months (Table 5).

Table 5: Post Hoc Main Effects for Attention and Affect at 12 and 15 Months.

	Attention		Affect	
	Coefficient	SE	Coefficient	SE
12 months				
Intercept	84.91***	7.83	1.30**	0.41
ASD Markers	-0.02	1.45	-0.04	0.08
PersonMOM	-9.27^{+}	4.6	0.61*	0.27
15 months				
Intercept	108.27	7.87	2.86***	0.35
ASD Markers	-5.50***	1.12	-0.21***	0.05
PersonMOM	-8.18^{++}	4.88	-0.16	0.14

Notes. ^{++}p=0.105, ^{+}p=.059, *p<.05, **p<.01, ***p<.001

The LME main effects models yielded a significant main effect of ASD Markers at 15 months (p<0.001), but not at 12 months (p=0.991), suggesting that attention did not differ by ASD Markers at 12 months, but as ASD Markers increased, attention to the distress display decreased at 15 months (Figure 5). Similarly, the LME main effects models for Affect at 12 and 15 months yielded a significant main effect of ASD Markers at 15 months (p<0.001), but not at 12 months (p=0.606), suggesting that affective

responses did not differ by ASD Markers at 12 months, but as ASD Markers increased, infants' affective responses decreased at 15 months (Figure 6).

The LME main effects models for Attention at 12 and 15 months also yielded marginally significant main effects of Person at both 12 (p=0.059) and 15 months (p=0.105), such that infants attended marginally more to EXP than MOM at both 12 and 15 months (Figure 5). In contrast, the LME main effects models for Affect at 12 and 15 months yielded a significant main effect of Person at 12 months (p=0.038), but not at 15 months (p=0.263), suggesting that infants had more affect for MOM than EXP at 12 months, but not at 15 months (Figure 6).

Figure 5: Post Hoc Estimated Attention by Person at 12 and 15 Months.

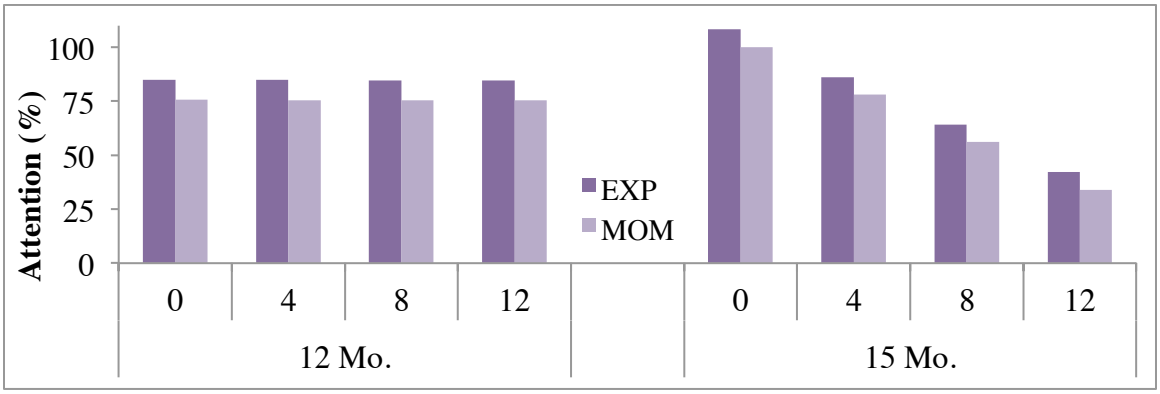
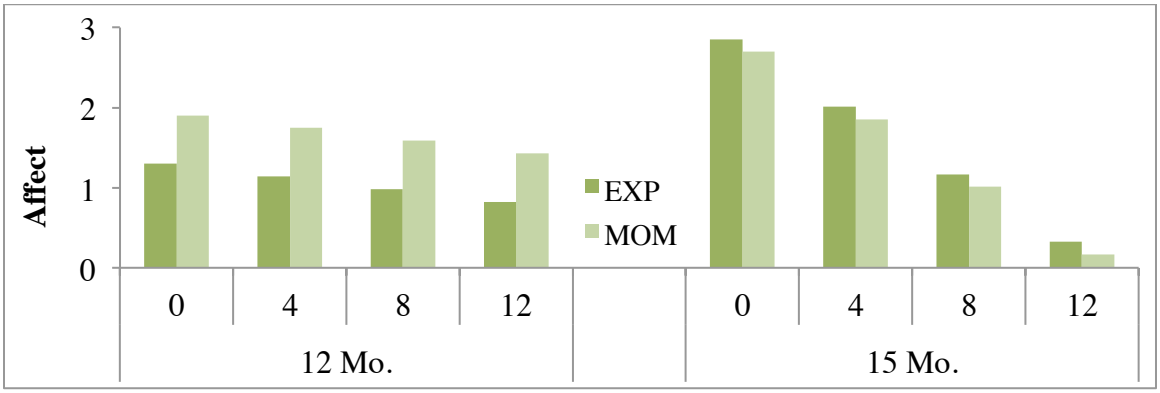


Figure 6: Post Hoc Estimated Affect by Person at 12 and 15 Months.



Discussion

Social Impairment Impacts Empathy

Attention

The current study found that the extent to which infants attended to another's distress varied depending on their age and level of social impairment. At 12 months of age, infants, across the full spectrum of social impairment, similarly attended to another's distress. However, by 15 months, infants with greater social impairment attended less to the distress of their social partner. Attention to the distress display appears to increase between 12 and 15 months for those infants with little to no social impairment. However, those with greater social impairment do not appear to be making the same developmental gains in empathic attention to their social partner.

Interestingly, the period between 12 and 15 months may be a particularly important time for the development of empathy as it relates to concurrent social impairment, as social impairment appears to impact attention at 15 months but not 12 months. These findings are consistent with those of Hutman et al. (2010), which found that, at 12 months, infants later diagnosed with ASD more often briefly attended (1-4 seconds, ~0.75) to the distress display than showed no interest (<1 second, ~0.18), whereas, by 18 months, ASD infants more often showed no interest (~0.5) than briefly attended (~0.3). Thus, Hutman's findings suggest that attention to the distress display decreased over time for those infants who were later diagnosed with ASD. Furthermore, Hutman also found that the proportion of both HR and LR non-ASD infants who exhibited sustained attention and clear interest towards their social partner's distress increased from 12 to 18 months. These findings suggest that in the absence of an ASD

outcome, attention to the distress display increased over time as it did for our low social impairment infants.

The current study expands upon Hutman et al. (2010) in two ways. First, our study narrows the developmental window during which the trajectories between high and low social impairment infants diverge with regard to cognitive empathy. Our results suggest that between 12 and 15 months of age, the development of cognitive empathy in high social impairment infants begins to deviate from the norm. Furthermore, contrary to their hypothesis, Hutman et al. (2010) did not find significant differences in attention between the HR and LR non-ASD groups. The current study attempts to understand why the HR non-ASD infants have a similar developmental trajectory to their LR non-ASD peers rather than their ASD peers. A proportion of HR non-ASD infants exhibit BAP characteristics, which were hypothesized to interfere with the development of empathic responses. However, Hutman et al. (2010) only assessed diagnostic outcome and did not directly assess how BAP characteristics may influence empathic responses. The current study expands upon the previous research by identifying how the full range of social impairment within and across these risk groups directly impacts empathic responses. It is important to assess this developmental relationship because, as observed in the current study, there are HR infants without any social impairment as well as LR with social impairment. While Hutman et al. (2010) did not see differences between the HR and LR non-ASD groups, the current findings suggest that the developmental trajectory for attention is negatively affected when BAP characteristics are present, suggesting that it is the amount of social impairment and not necessarily diagnostic outcome, that may be important to understanding individual differences in early empathic responses.

Affect

Similar to the study findings with regard to attention, social impairment did not appear to influence infants' affective responses at 12 months. In fact, affective responses appeared generally limited at 12 months (Affect mean= 1.45), consistent with those reported in Hutman et al. (2010). Hutman et al. (2010) similarly did not find significant differences between the ASD and LR non-ASD groups in their affective responses at 12 months. Interestingly, the HR non-ASD group had greater affective responses than both the ASD and LR non-ASD groups at 12 months, further supporting the current finding that affective responses are not influenced by social impairment at 12 months. Together these findings suggest that these affective responses may only be first emerging at 12 months with little variability in responses across infants. However, by 15 months, we found that as infant social impairment increases, the less emotionally responsive they were to their social partners' distress. While affective responses appear to increase marginally between 12 and 15 months for those with little to no social impairment, those with social impairment did not appear to be making the same developmental gains. This failure to progress is supported by the lack of developmental gains observed in Hutman et al. (2010), which found similarly large proportions of infants in the ASD group who ignored their social partners' distress or displayed no affect at both 12 and 18 months. The marginally significant increase in affect over time for those with little to no social impairment in the current study is also consistent with the increase in affect observed in both the HR and LR non-ASD groups between 12 and 18 months (Hutman et al., 2010). The current study expands upon the previous research by demonstrating that social impairment, and not only autism spectrum disorder, can impact affective responses prior to 18 months, and specifically, as early as 15 months.

Implications

These findings contribute to understanding when and how failures to empathize first develop in the context of concurrent social impairment, which will help inform when early interventions should be undertaken. Given that greater social impairment, as indicated by ASD Markers, was related to normative empathic responses at 12 months but lower empathic responses at 15 months, early social interventions should be undertaken prior to 15 months to support optimal development. However, most children are not evaluated for, much less diagnosed with ASD at 15 months (Centers for Disease Control and Prevention [CDC], 2015). By using tools such as the AOSI, children with high social impairment can be identified and referred for early intervention. Even if these children with high social impairment are not later diagnosed with ASD, they may still benefit from these early interventions.

Familiarity Impacts Empathy

Attention

The current study found that infants attended marginally more to the distress display of the unfamiliar person (experimenter) than to the familiar person (mother) at both 12 and 15 months. Knafo et al. (2008) likewise found that infants displayed more inquisitiveness (cognitive empathy) for the experimenter at 14 months. The current study extends this research by showing a similar pattern of attention at 12 months. One explanation for the increased attention to the experimenter early in development is that emotion recognition may be more challenging with unfamiliar faces. Research has demonstrated that young infants (3.5 months) were better at identifying emotions in familiar faces, as the infants only demonstrated preferentially looking for paired facial and vocal expressions for the familiar face (Montague & Walker-Andrews, 2002). As

infants are thought to identify expressions of their primary caregiver before they become sensitive to other's expressions (Montague & Walker-Andrews, 2002), infants may require additional looking time in order to identify the emotions of unfamiliar people. Future research is needed to directly assess for infants' ability to recognize emotion recognition in both familiar and unfamiliar faces at each age and to identify how emotion recognition skills are related to infants' attention toward a person in distress.

Affect

The degree of familiarity with the person in distress appears to strengthen infants' affective responses toward the familiar person at 12 months, but not at 15 months. At 12 months, infants were more affectively responsive to their mother in distress. Between 12 and 15 months, infants showed increased affective responses to the experimenter in distress, such that infants responded similarly to the experimenter in distress as they did to their mother in distress by 15 months. Therefore, while affective responses to distress at 12 months may be limited to familiar social partners, affective responses to distress at 15 months appear to have generalized to unfamiliar social partners. It may be that the limited affective responses at 12 months for the experimenter is the result of stranger anxiety, which emerges around 8-10 months of age and increases throughout the first year of life (Sroufe, 1977). Whereas, affective responses may be similar for both the familiar and unfamiliar person in distress at 15 months as stranger anxiety gradually declines during the second year of life (Sroufe, 1977).

Regardless of the possible role of stranger anxiety, it is important to note that the current study expands upon the previously mixed research findings. For example, van der Mark and colleagues (2002) found greater affect for familiar social partners when children were 16-22 months, while Knafo and colleagues (2008) found greater affect for

unfamiliar social partners at 14 months. The current study suggests that affective responses may vary by the familiarity of the social partner over time starting with a stronger response to familiar adults in young (12 month) infants and only generalizing to unfamiliar social partners as infants approach 15 months.

LIMITATIONS AND FUTURE DIRECTIONS

It is important to acknowledge the limitations of this study. First, we had a modest sample size (n=39), and some of the infants only contributed data to one of the two time points. Due to recruitment challenges with the HR population, more HR infants participated in the study at 15 months (n=17) than at 12 months (n=11). This study should be replicated with a larger sample, containing equal numbers of HR and LR infants at each time point. With a larger sample size and equal HR and LR groups, future studies may be able to account for the unknown variance over time that was suggested by our LME model for Affect.

This study also did not counterbalance the order of presentation of the distress display across the mother and the experimenter. All infants were presented with the maternal distress display first, and the experimenter distress display second. One concern when measuring attention in infants is that infants would habituate more quickly to the second distress display, as it would be more familiar to them. If this were the case, we would expect to find lower attention toward the second (experimenter) distress display. However, attention was actually higher for the experimenter than the mother in distress in this study. Thus, if habituation were occurring, it only served to attenuate what may be a strong response to the experimenter. In order to fully elucidate the strength of the effect across experimenter and mother, future studies should counterbalance the order of presentation across the familiar versus unfamiliar social partner.

Finally, the AOSI was used as the only measure of social impairment in this study. The AOSI captures information about atypical behaviors that have been identified as the earliest signs of ASD. This information includes some behaviors that are not specific to social interaction, per se (e.g., attention disengagement, visual tracking, etc.). Arguably, these more general processes, when impaired, may interfere with optimal social interactions and be relevant to social functioning. For example, while restricted repetitive behaviors (e.g., hand flapping, rocking, finger wiggling) are not considered symptoms of social impairment in ASD, restrictive repetitive behaviors have been shown to interfere with attending to and participating in social interaction (Boyd, McDonough, & Bodfish, 2012; Koegel, Firestone, Kramme, & Dunlap, 1974; Loftin, Odom, Lantz, 2008; Nagid, Lee, Singh, Bosshart, & Ozonoff, 2010; Nuzzolo-Gomez, Leonard, Ortiz, Rivera, & Greer, 2002). Future research should utilize multiple measures to assess for social impairment, including measures of social impairment that do not include these non-social developmental processes (e.g., attention disengagement, visual tracking, etc.). Additional measures of social impairment might include the "Reciprocal Social Interaction" section of the ADOS-2 (Lord et al., 2012) or creating an index by identifying particular items on the AOSI (e.g., excluding 'Visual Tracking'; including 'Engagement of Attention' and 'Sharing Interest', which are not included in the scale's AOSI total marker count).

CONCLUSION

Despite a modest sample size, the current study did find significant differences that meaningfully contribute to and expand upon the existing research on the early development of empathy. This study is unique in that it attempts to understand how the full spectrum of social functioning is related to the development of empathy, as well as

how familiarity with the person in distress may yield different empathic responses early in toddlerhood. The most important findings suggest that: 1) social impairment may interfere with the development of empathy between 12 and 15 months of age, resulting in less attention and fewer affective responses that differentiate infants with social impairment from their more socially capable peers at 15 months; and 2) infants' empathic responses are influenced by their familiarity with the person in distress, resulting in greater attention to the experimenter over time and the generalization of affective responses from the mother only at 12 months to both the mother and experimenter at 15 months.

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